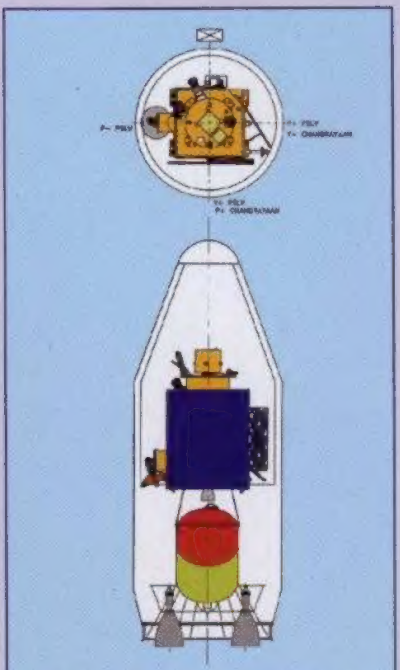
PSLV-C11
CHANDRAYAAN-1
MISSION

PSLV-C11/CHANDRAYAAN-1 MISSION

PSLV-C11 is the eleventh operational flight after three developmental flights. It is the first mission of PSLV using PSOM-XL, the upgraded strap-on booster. The newly introduced PSOM-XL is a stretched version of regular PSOM (longer by 3.4 m) carrying 3.3 tonnes of extra propellant in each. PSLV-XL will have a modified core base shroud. This variant can increase the PSLV payload capability from 1600 to 1750 kg in 600 km polar orbit.

The vehicle will place India's first lunar spacecraft, Chandrayaan-1 weighing 1380 kg in an Elliptical Transfer Orbit (ETO). The spacecraft is transferred to a highly elliptical orbit with apogee of 3,84,246 km by multiple apogee raising maneuvers. This is followed by mid course correction and subsequent Lunar Orbit Insertion (LOI) maneuver to capture Moon's polar orbit in 500 x 7500 km. Subsequent in-plane maneuver will place Chandrayaan-1 in 100 km circular orbit around Moon.



Chandrayaan-1 accommodation in PSLV-C11 Heat Shield

PSLV-C11/Chandrayaan-1 marks ISRO's beginning in inter planetary missions.

MISSION SPECIFICATION

Orbit	:	255 x 22860 km elliptical (ETO)
Inclination	:	17.9°
Launch time	:	06:22 Hrs IST
Launch window	:	15 mins
Launch pad	:	Second Launch Pad
Launch azimuth	:	102°

VEHICLE

Overall height	»	44.5 m
Lift-off mass	»	320 ton
First stage	»	PS1 (S139 + PSOM-XL) HTPB Solid Propellant
Second stage	»	PS2 (PL40), UH25 + N_2O_4, Liquid Propellant
Third stage	»	HPS3, HTPB Solid Propellant
Fourth stage	»	PS4 (L2.5), MMH + MoN3 Liquid Propellant

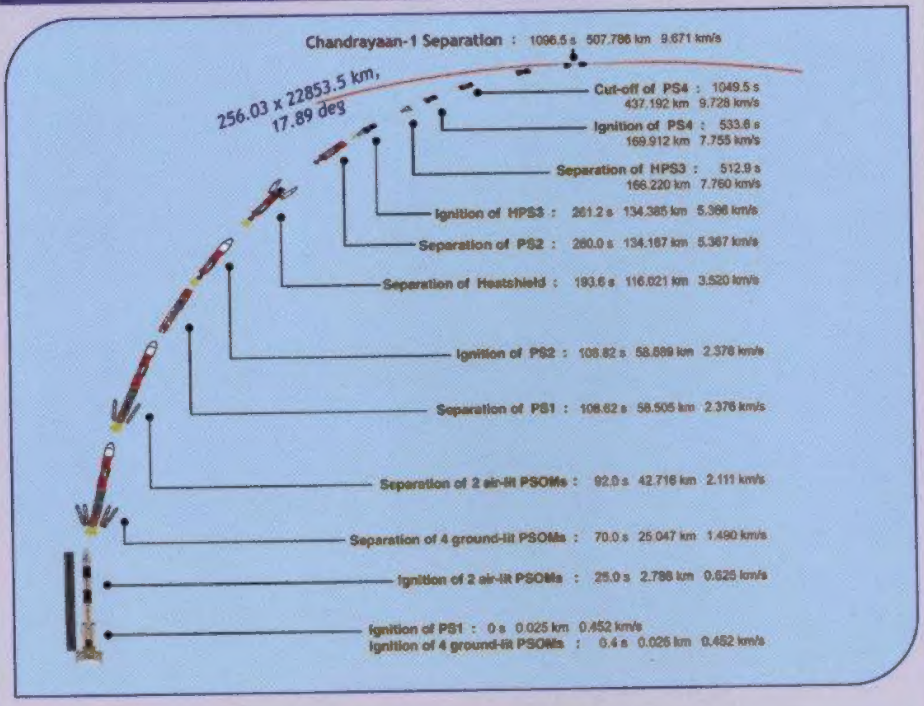
MAJOR CHANGES FROM PSLV-C9

- Introduction of PSOM-XL.
- PS1 Pressure sensing logic for early ignition of PSOM-XL.
- Sit on umbilical as a redundant measure for PS1 pressure sensing.
- PSOM-XL pressure monitoring scheme improved with redundant 'O' ring shaft seal.
- Improved wet life for pyro valves in RCS.
- CBS redesigned for PSLV-XL.
- TPS modified for 150°C limit.
- RMSA based ignition for PSOM-XL.
- Re-introduction of SITVC in Airlit PSOM.
- PS4 destruct system re-introduced.

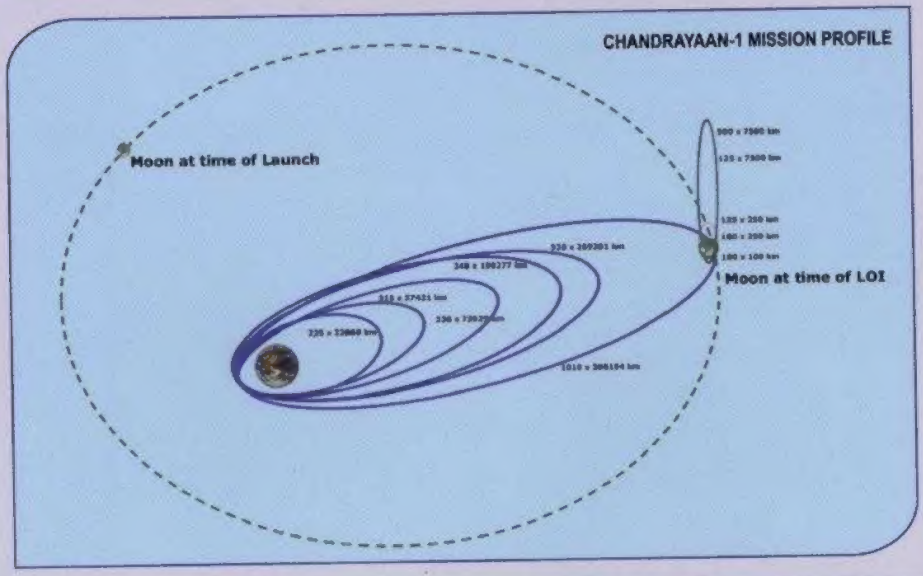
OPERATIONAL FLIGHTS

PSLV-C1	29 September 1997	IRS-1D
PSLV-C2	26 May 1999	IRS-P4, KITSAT, TUBSAT
PSLV-C3	22 October 2001	TES, PROBA, BIRD
PSLV-C4	12 September 2002	KALPANA-1
PSLV-C5	17 October 2003	IRS-P6
PSLV-C6	5 May 2005	IRS-P5, HAMSAT
PSLV-C7	10 January 2007	CARTOSAT-2, SRE, LAPAN TUBSAT, NANO PEHUEN SAT
PSLV-C8	23 April 2007	AGILE
PSLV-C10	21 January 2008	POLARIS
PSLV-C9	28 April 2008	CARTOSAT 2A, IMS-1 & 8 NANO SATELLITES

FLIGHT PROFILE



REACHING THE MOON



PAYLOADS IN CHANDRAYAAN-1

Terrain Mapping Camera (TMC)

TMC is aimed to map topography in both near and far side of the Moon and prepare a 3-dimensional atlas with high spatial and altitude resolution. It will image in the panchromatic spectral region of 0.5 to 0.85 μm with a spatial/ ground resolution of 5m, 10 bit quantization and swath coverage of 20 km.

Dimension: 370 x 220 x 414 mm. TMC is developed by ISRO and weighs 7 kg.

Hyper Spectral Imager (HySI)

HySI is aimed to obtain spectroscopic data for mineralogical mapping of the lunar surface. This data will help in studying the mineral composition of the lunar surface and in understanding the mineralogical composition of Moon's interior.

Dimension: 275 x 255 x 205 mm. HySI payload weighing 4 kg is developed by ISRO.

Lunar Laser Ranging Instrument (LLRI)

LLRI is aimed to prepare the altimetric map of the Moon which will help in studying the morphology of large basins and other lunar features, study stress, strain and flexural properties of the lithosphere. This when coupled with gravity studies would provide the density distribution of the crust.

LLRI is developed by ISRO and weighs 10 kg.

High Energy X-ray Spectrometer (HEX)

HEX covers the hard X-ray region from about 30 keV to about 250 keV. This is the first experiment to carry out spectral studies of planetary surface at hard X-ray energies using good energy resolution detectors. It is designed primarily to study emission in the above energy range due to radioactive decay of the ^{238}U and ^{232}Th in the lunar surface region.

HEX is developed by ISRO and has a mass of 16 kg.

Moon Impact Probe (MIP)

MIP will ride piggyback on the top deck of the main orbiter and will be released at a predetermined time after the orbiter reaches the final 100 km orbit to impact at a pre-selected location. This will help in design, development and demonstration of technologies required for impacting a probe at a desired location on the Moon.

Dimension: 375 x 375 x 470 mm. MIP weighing 32 kg is developed by Vikram Sarabhai Space Centre, ISRO.

Chandrayaan-1 X-ray Spectrometer (C1XS)

C1XS is aimed to carry out high quality X-ray spectroscopic mapping of the Moon. C1XS would use X-ray fluorescence technique (1.0-10 keV) for measuring elemental abundance of Mg, Al, Si, Ca, Fe, Ti distributed over the surface of the Moon.

C1XS is realized through ESA with collaboration between Rutherford Appleton Laboratory, UK and ISRO Satellite Centre.

Near-IR Spectrometer (SIR-2)

SIR-2 will address the surface-related aspects of lunar science by analyzing in unprecedented detail the lunar surface in various geological/ mineralogical and topographical units. It will help to study the vertical distribution of crustal material, investigate the process of basin, maria and crater formation on the Moon.

SIR-2 is developed by the Max-Plank-Institute for Solar System Science, through the Max-Plank Society, Germany and ESA.

Miniature Synthetic Aperture Radar (MiniSAR)

MiniSAR is an onboard radar mapper that will allow viewing of all permanently shadowed areas on the Moon, regardless of whether sunlight is available or the angle is not satisfactory.

MiniSAR is from Applied Physics Laboratory, Johns Hopkins University and Naval Air Warfare Centre, USA through NASA.

Sub keV Atom Reflecting Analyser (SARA)

SARA will image the Moon surface using low energy neutral atoms in the energy range 10 eV-2 keV. It will help in the imaging of the Moon's surface composition including the permanently shadowed areas, solar wind surface interaction and the lunar surface magnetic anomalies studies of space weathering.

SARA is realized through ESA, in collaboration with Swedish Institute of Space Physics, Sweden and Space Physics Laboratory, Vikram Sarabhai Space Centre, ISRO and weighs 4 kg.

Radiation Dose Monitor Experiment (RADOM)

RADOM will qualitatively and quantitatively characterize, in terms of particle flux, dose rate and deposited energy spectrum, the radiation environment in near Moon space.

RADOM is from Bulgarian Academy of Sciences.

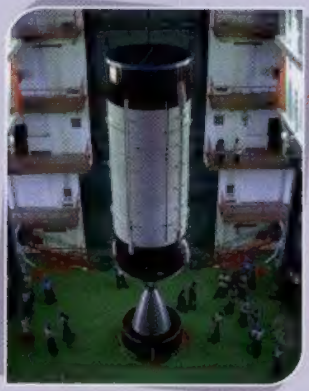
Moon Mineralogy Mapper (M3)

The primary Science goal of M3 is to characterize and map lunar surface mineralogy in the context of lunar geologic evolution. This translates into several sub-topics relating to understanding the highland crust, basaltic volcanism, impact craters, and potential volatiles.

M3 payload weighing 7 kg is from Brown University and Jet Propulsion Laboratory, USA through NASA.

PSLV-C11 LAUNCH CAMPAIGN

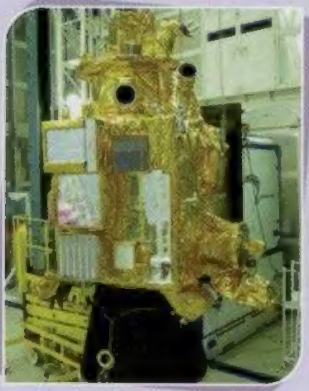
PS1 at VAB



PS2 Assembly

PS3-PS4 Moduling

EB Testing at VAB



Satellite Assembly

Heat Shield Closure

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